HUD DOE

Distict Heating and Cooling Assessment Program

Final Review Conference

October 26-28, 1982

St. Paul, MN

Comment

A major effort in preparing for this conference was the development of an informal format where speakers and the audience could communicate directly. To avoid an "on/off the record" situation, it was decided not to record and transcribe the complete program. A team of rapporteurs from the University of Minnesota was engaged to take notes of the presentations and prepare a summary of each speaker's remarks. These were compiled by the IDHA staff and each of the speakers was sent the rapporteurs's account for approval, or if so desired substitute a prepared statement. While simple in concept, this became a colossal task and spanned about 10 months of time. While most presenters reported promptly and effectively some failed to answer repeated letters and telephone calls were generally to no avail. All too often returned copy contained technical errors that had to be resolved and the process was repeated.

CONFERENCE SCHEDULE

28 CITIES DISTRICT HEATING ASSESSMENT PROGRAM

October 26, 1982

9:00 A.M.
Why we are in Minnesota
Wyndham Clarke, HUD

9:30 A.M.
Keynote Speaker
Mayor George Latimer, City of St. Paul

10:00 A.M.
Tax and Regulation Update
David Gatton, U.S. Conference of Mayors
Edward Maguire, Buchanan, Ingersoll, Rodewald, Kyle and Buerger

11:00 A.M.
Marketing and Rate Design Panel
Ron Visness, Minnesota Energy Division
Ken Linwick, Minnegasco Energy Center
Carroll Easton, Carroll Easton Company
Jim Miller, Bloomquist, Miller Real Estate
Ernst Habicht, Energy Consultant and Policy Analyst

12:15 P.M.
Luncheon Speaker
Mayor Donald Fraser, City of Minneapolis

2:00 P.M.
Concurrent Sessions: City Presentations

Large Cities, Wyndham Clarke
Atlanta, GA
Columbus, OH
Dayton, OH

Small Cities, Floyd Collins
Bellows Falls, VT
Devil's Lake, ND
LaGrande, OR

3:45 P.M.
Poster Session - featuring Minnesota City Project

October 27, 1982

9:00 A.M.
Concurrent Sessions: Financing and Investment Panels
Municipal Financing
Ted Capus, DOE, Moderator
Bob Pulscher, Springsted Corporation

Dean Finn-Carlson, Touche Ross and Company

Private Financing
John Millhone, DOE
Donald Dodge, HUD
Daniel Harkins, CSI Resources Inc.
Anthony Carey, City of Baltimore Project

10:30 A.M.
Concurrent Sessions: City Presentations

Cogeneration Energy Sources	Refuse Sources
Norman Taylor, Moderator	Andrew Euston, Moderator
Holland, MI	Baltimore, MD
Springfield, MA	Gary, IN
Provo, UT	Lawrence, MA

12:15 P.M.
Luncheon Speaker Stuart Sloame, HUD, Introduction
Katherine Sasseville, Otter Tail Power Company, Speaker

2:15 P.M.
Retrofit of a Steam District Heating System to Hot Water
Michael Nitchals, Minnesota Municipal Utilities Department

2:45 P.M.
Design Alternatives to Attain Financial Feasibility
Jim Powers, Metcalf and Eddy

3:15 P.M.
District Heating and Industrial Development
Bill Lundy, Project Developer

4:00 P.M.
Workshop/Discussion Groups
1. Developing A Constituency in the City and State Legislature
Monica Krautbauer, Moderator, District Heating Development Company
Delbert Anderson, Member Minnesota Energy Policy Development Council
Ron Sundberg, Minnesota Department of Energy Planning and Development

2. Refuse to Energy
Floyd Forsberg, Moderator, Henningson, Durham & Richardson
Dean Massett, City Council Administrator, Red Wing, MN
Luther Nelson, Hennepin County
Richard Person, City of St. Paul

3. Financing and Ownership
Ken Tocke, Moderator, Touche Ross and Company
Jim O'Leary, City of St. Paul Department of Planning and Economic Division
Bob Sylvester, Piper, Jaffery, Hopwood

Larry Christensen, Buchanan, Ingersoll, Rodewald, Kyle & Buerger

4. Customer Contracts
Bill Mahlum, Moderator, DH Legal Consultant
Kenneth Linwick, Minnegasco Energy Center
John Sprangers, District Heating Development Company
Carroll Easton, Carroll Easton Company
Bill Lundy, Bagley Industrial Development Commission

5. Customer Building Conversion & Economics
Rudy Brynolfson, Moderator, District Heating Development Company
Alex Sleiman, HDR

6. Developing Project Design Alternatives
Jim Powers, Moderator, Metcalf & Eddy
Ishai Oliker, Burns and Roe, Inc.
Bonnie Mitchell, District Heating Consultant, Virginia, MN

7. Interface with Private Utility
Peter Jones, Northern States Power Company

5:00 P.M. City Presentations
Bernard Manheimer, Moderator
New York, NY
Norwalk, CT
Ecourse, MI

Thursday, October 28, 1982

9:00 A.M. Keynote Speaker
Congressman James Oberstar, 8th District, Minnesota

9:30 A.M. Concurrent Sessions: Involvement of Local Utility in District Heating
Clement Crooks, Moderator, President, International District Heating Association
Ishai Oliker, Burns and Roe, Inc.
Anthony Mirabella, Hartford Steam Service Company
Ronald McIntyre, Detroit Edison Company
Charles Fritke, Virginia, MN, Municipal Power Company

Panel on Refuse Energy
David Gatton, Moderator, U.S. Conference of Mayors
Lewis Cohen, CSI Systems
Michael Gagliardo, Northeast Maryland Waste Disposal Authority
Bill Hanselman, Resource Development Associates

11:00 A.M. Wrap-up Assessment of 28 Cities District Heating Program

12:15 P.M. Luncheon Speaker
Albert Quie, Governor of Minnesota

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
U.S. DEPARTMENT OF ENERGY

NATIONAL DISTRICT HEATING AND COOLING ASSESSMENT PROGRAM

Final Review Conference
October 26-28, 1982
St. Paul, MN

OPENING OF THE CONFERENCE
WHY WE ARE IN MINNESOTA

Wyndham Clarke

Mr. Clarke introduced the groups involved in the conference: the U.S. Conference of Mayors, Edison Electric Institute, the American Public Power Association, and the International District Heating Association. He extended his thanks to the Upper Midwest Section of IDHA and the Minnesota Department of Energy Planning and Development who were hosts in St. Paul and to his colleague in the Department of Energy, John Millhone, for DOE's particpation in the 28 City District Heating Assessment program.

Mr. Clarke explained the reason for holding the conference in Minnesota was to highlight the major role the state has played in the promotion of district heating on a national level and to permit the interaction of the delegates from the 28 HUD/DOE cities and those representing Minnesota cities.

Minnesota has several district heating systems in place or under development including the Minnegasco system in Minneappolis and the new hot water system soon to be built in St. Paul. The state has also awarded grants to 16 of their cities to review district heating much the same way as the 28 HUD/DOE cities. These activities emphasized the major theme of the conference--"maintaining momentum in DH development."

Clarke noted that there are many encouraging developments in the district heating industry. The 28 cities project has helped to develop an interest of mayors in district heating, and this in turn has encouraged HUD to provide funds for the second phase for the project.

KEYNOTE SPEECH

George Latimer, Mayor, City of St. Paul

Mayor Latimer's introduction lauded district heating's contribution to an energy poor state like Minnesota and to the economic future of St. Paul. He stressed that St. Paul's economic and community development rests with future energy development, and that DH meets these future energy needs.

The St. Paul project began in early 1979 when Ron Sundberg, Ron Visness and Alice Murphy met with Mayor Latimer to discuss the possibilities of DH and conservation. They developed a funding proposal which was presented to and accepted by the U.S. Department of Energy Northern States Power Company, the State of Minnesota, and the City of St. Paul to cooperatively fund the project for its study phase.

As a result, the City of St. Paul, the St. Paul Building Owners and Managers Association, the State of Minnesota, local trade and labor organizations, Northern States Power Company, and a number of concerned citizens established the District Heating Development Company as a non-profit corporation to develop a hot water district heating system for St. Paul using the appropriated funds. To lead the effort, the group chose Hans O. Nyman, a hot water district heating engineer and former Minnesota Energy Agency consultant.

The results of the project's study phase were positive and the decision was made to proceed with final planning and system design. When DHDC applied to DOE for funds to conduct this detailed assessment and planning, DOE staff allocated the money in their budget planning in May of 1980. This allocation was rescinded, however, in February of 1981. Luckily HUD was able to pick up the remaining cost with an Urban Development Action Grant.

The project's momentum increased when a coal-fired heating plant was purchased from Northern States Power Company. St. Paul also has the option of future conversion to renewable resources. Continued assessment showed the expected 165 MW load would not be reached and a revised goal of 135 MW was recommended.

In July of 1981 organizations and companies began to sign 30 year contracts to use DH. These contract negotiations were long and laborious, but the user load goal was achieved with 73 building contracts. Loans will be made available to non-profit organizations which cannot raise the initial retrofit funds. These loans are made available through a Consortium Foundation Fund on the terms that the loans be repaid as energy cost savings are realized.

In retrospect, Mayor Latimer views the most important elements of the project as:

-the active support of all members
-UDAG support
-user and owner cooperation
-community support

In addition, the DH project benefits the people of St. Paul through investment in their future, and the increased federal, state and community involvement. St. Paul is now looking forward to an operating system in 1983, increased employment, and a more self-reliant energy future.

10:00 A.M.

TAX REGULATION UPDATE

David Gatton, U.S. Conference of Mayors
Edward Maguire, Esq., Buchanan, Ingersoll, Rodewald, Kyle and Buerger

David Gatton

Mr. Gatton mentioned HUD's interest in pursuing district heating and a recent congressional statement which commended HUD for its work in the 28 cities. Mr. Gatton hopes this work will continue through fiscal year 83 during which an equivalent amount of funding should be made available by HUD for additional feasibiltiy work. He noted the recent national energy issues have centered as much around control over distribution systems as supply. He cited the Alaskan and Soviet natural gas pipelines as examples.

Edward Maguire

Mr. Maguire presented an update on the tax treatment of district heating and cooling systems, with particular reference to the recent tax legislation passed by Congress in the summer of 1982. As a result of the efforts of the International District Heating Association, the U.S. Conference of Mayors and Mr. Maguire's law firm, Buchanan, Ingersoll of Washington, D.C., the availablity of tax-exempt industrial revenue bond financing under section 103 of the Internal Revenue Code was extended to local district heating and cooling facilities. Under the new provision enacted as part of the Tax Equity and Fiscal Responsibility Act of 1982, IRB financing is available for district heating or cooling distribution pipe that is part of a local district heating or cooling system. The production and generating equipment is not included within the new eligible catagory, and retrofit equipment is eligible if it is owned for tax purposes by the producer, rather than the consumer.

Mr. Maguire went on to discuss a number of other areas which remain unclear under the law and for which a legislative solution will be sought in the future. He pointed out that there remains some uncertainty as to whether or not district heating and cooling distribution pipe is eligible for the basic 10 percent investment tax credit. The Internal Revenue Servicce ruled in 1968 that steam distribution pipe was not eligible for the 10 percent credit; however, this position was reversed in the summer of 1981, with respect to steam distribution pipe that consitutes public utility property, leaving uncertain the treatment of hot water distribution pipe and pipe that is not public utility property. In adddition, he

pointed out that this lack of clarity could create problems with the characterization of distribution property for purposes of depreciation since the definitional scheme under the Accelerated Cost Recovery System (ACRS) introduced by the Economic Recovery Tax Act of 1981 is nearly identical to the definitional scheme under the investment tax credit. If distribution pipe is not eligible for the investment tax credit, it is likely that it would have to be in the 15-year ACRS category rather than the 5-year ACRS category.

Mr. Maguire pointed out that Senate Bill S2025 introduced in January of 1982 by Senator Durenberger of Minnesota would have clarified these issues and provided a number of other benefits for district heating. In particular, the bill provided:

1. IRB treatment for district heating;
2. Additional 20% energy tax credits;
3. Clarification of the investment tax credit and ACRS questions and certain miscellaneous provisions improving the tax treatment of district heating facilities that are used by or transferred to a municipality.

The IRB provision of Senator Durenberger's bill was successfully make part of the Tax Equity and Fiscal Responsibility Act of 1982.

Mr. Maguire concluded his remarks by urging continued support in the future of efforts to improve the tax climate for district heating.

11:00 A.M.

MARKETING AND RATE DESIGN PANEL

Ron Visness, Director of the Office of Energy Analysis, Minnesota Energy Division, Moderator
Carroll Easton, President, Carroll Easton Company
Ken Linwick, President, Minnegasco Energy Center
Jim Miller, Bloomquist, Miller Real Estate
Ernst Habicht, Ph.D. Energy Consultant and Policy Analyst

Ron Visness

Ron Visness briefly discussed the history of district heating (DH) in Minnesota. In 1975, a legislative committee looked at hot water heating systems in Sweden and Finland. In 1977, $40,000 was appropriated to study the potential of DH in Minnesota. Studies indicated that the marketing of the system is the most difficult step, even in comparison with the engineering, economic, and building tasks.

Carroll Easton

Carrol Easton, former president of the Seattle Steam Company and currently serving industry as a management and business consultant, reported that many D.H. companies are experiencing much competition with other heat sources. As a consultant to the St. Paul Hot Water District Heat project since 1979, Mr. Easton witnessed the tremendous problems the project has dealt with trying to market a new hot water DH system in an area currently being served by an exisiting steam DH system. St. Paul's mayor, George Latimer, serving as a lead spokesman for DH, formed a unique partnership of government and the private sector business community to lead the project forward to successful initial implementation.

Ken Linwick

Ken Linwick described the new combined district heating and cooling (DHC) system installed in downtown Minneapolis. With $11 million invested in steam and chilled water; 160 MW of heating steam and 20,000 tons of cooling are presently delivered to customers through a compact and efficient system. Losses in the system are less that 3% and only a few employees are required; the labor cost is 40 cents/M lbs of steam sold.

Minnegasco Energy Center (MEC) was the first company to insist on long-term (20 Year) contracts with its customers in order to protect its investment and plan for the future. Eighty percent of these

customers joined the steam system within the last 10 years. Steam rates depend on three constituent factors: 1) the demand rate, which is based on peak-hour use, 2) the commodity rate, and 3) the escalation rate. Seventy-five percent of the rate is based on the operating cost, which is adjusted annually. Twenty-five percent of the rate is based on fixed costs adjusted every five years.

When estimating costs for potential customers, MEC compares the customers past fuel use, fuel cost, labor, and insurance costs with the same costs when using the DH system. MEC has found that the older systems usually prove less cost efficient than DH. However, achieving greater efficiency depends on the customer's present system. Owners of new buildings can usually be persuaded to incorporate the use of DH into their plans. In existing buildings with high-pressure in-house steam plants and a low efficiency of 40-50%, DH is also easy to market. In existing buildings with low pressure systems, however, DH is often less competitive and less attractive.

Customers typically ask the following questions regarding DH costs.

Q. How much will it cost to connect to the system initially?
A. If a steam system already exists in the customer's building, $8-10,000 is a good estimate.

Q. How much will the rate increase when new plant equipment is added?
A. The rate is independent of the cost of additional new plant equipment.

Q. How can the customer know that the system will still be the most efficient system 5 years from now?
A. MEC plans to use the most sophisticated equipment and will pass on any cost savings to the customer.

Jim Miller

Jim Miller, the president of a commercial property company in St. Paul, presented a customer's view of the DH system. Mr. Miller was part of a committee formed by DH proponents and potential customers to redraft the St. Paul District Heating Development Company contract.

In St. Paul's original market analysis, 200 MW worth of load were considered necessary to run the system successfully. Customers totaling 175 MW were targeted for the initial marketing campaign, 128 MW were initially signed and expected to hook up as the system is built.

One of the keys to the success of the St. Paul system was the Design Decision Document which explained the system to potential customers. When the project suffered a setback due to the exclusion of cogeneration from the project, this document helped to alleviate the fears customers felt about high property taxes and the loss of control over their own energy systems.

Two major marketing obstacles were overcome. The first obstacle involved conversion costs. Four hospitals managed to pay for their own equipment changes, but 29-30 churches were financed by the Wilder and Minnesota Foundations with the stipulation that the energy savings be used to repay these funds. The Port Authority created a pool of funds to cover conversion costs for downtown buildings. Mr. Miller noted that Mayor Latimer's support was crucial in converting the city and federal buildings to the DH system.

The second obstacle, the conversion risks, was addressed by the Board of Directors composed of three public representatives, three customer representatives, and a board appointed member. These risks included: operation efficiency, management identification, aggregate demand decline, underestimated construction costs and time requirements, rate changes, possible fuel alternatives, conversion difficulties, expansion charges, and a shortage of mechanical contractors to build the system.

Mr. Miller believes the rate structure should be based on the demand rate which is the total service, administrative, and energy costs at the peak use period. He concluded by saying that, as a customer, he will agree to any rate structure that is fair and equitable.

Ernst Habicht

Ernst Habicht, as an energy consultant to utilities, approached rate design from an economist's point of view. He said that the goal of a system planner is to maximize the economic welfare of suppliers and users of DH and to anticipate changes in technology, costs, and taxes by creating a flexible rate design.

Dr. Habicht emphasized that the rate structures and resulting prices are important parts of demand. Factors such as time-of-day metering, demand costs, and type of meters can greatly effect customer response to load and to other cost saving attitudes.

Marginal costs are an important component of rate structures and also provide a direct incentive for conservation of the users receive part of the paybacks. These marginal costs vary over time, and the rates must reflect these changes. In a cogeneration DH system, the

increased revenue resulting from off-peak hour use should be reflected in reduced user rates.

Dr. Habicht stated that various rate design constraints must exist. Rates must recover enough revenues to cover all costs including fixed charges, variable costs, and expansion costs. Marginal costs determine the final block of the rate structure and are estimated by analyzing the discreet costs or benefits accrued due to consumption or conservation decisions made by DH users. Marginal rate levels, therefore, must include additional fuel costs, labor costs, and customer-specific costs, such as metering and bookkeeping.

Rates should be equitable and flexible to promote customer understanding. According to Habicht, a mechanism for rate redesign must also be included in the contract to account for changes over time. Large rate changes should be phased in over several years and automatic adjustments should provide incentives for good economic behavior; fixed changes by contract can lead to disaster. Some of the problems experienced by utilities today result from rates which do not reflect costs.

12:15 P.M.

LUNCHEON SPEAKER

Don Fraser, Mayor, City of Minneapolis

Mayor Don Fraser

Mayor Fraser pointed out that district heating (DH) has been developed and operating in Minneapolis for a number of years.

In 1980, the city established a Citizen's Task Force to take a broader approach concerning energy and conservation. The Task Force found the levels of energy consumption to be $115 million/year in the residential sector and $260 million/year for the commercial and industrial sectors. By the end of this decade alone, over $1 billion will have been spent on energy. The Task Force concluded that this high energy cost turns business towards the Sunbelt. A 10-year action plan was developed to reduce consumption by one third. The action plan included everything from no-cost neighborhood workshops, to million-dollar projects using DH. The DH plan would improve pollution controls, develop abundant energy, and stabilize heating costs.

The conservation effort was aimed at residential areas first by offering neighborhood workshops on a block by block basis. Five thousand homeowners have been involved so far. Also, an energy bank was created to offer low-cost, tax-exempt financing loans in the amount of $350-$3,000. These loans would total $2 million and reach 900 households. Landlords have no incentive to spend on conservation since they tend to pass on higher energy cost to tenants.

The Task Force found it feasible to connect the existing downtown district heating system, which was gas and oil, to the Northern States Power (NSP) coal-fired plant four miles north of the city. A partnership between the private and public sector would have to be established to provide for this steam line. The study showed that the plan would save fuels, spur economic growth, and provide heat to the growing communities along the river. Therefore, the Task Force concluded that the Minnepaolis project was feasible.

NSP also conducted a study, which resulted in a similar price ($29 million) and reached similar conclusions. However, the pipe line route in the NSP study was different, and NSP cited 400 PSI rather than 600 PSI. On the whole NSP's study confirmed the city's report. Both DH plans would use cogeneration as long as the cost savings could be passed on to the customers.

Looking to the future, Fraser noted that need for legislation to minimize the use of land fills and burning. One problem that still remains is that a solid waste disposal facility could not be efficiently tied into the NSP plant because of varying seasonal demands. It looks feasible to implement the extended plan near the central business district, thereby concentrating businesses in this area and making Minnesota competitively attractive to business and industry.

The entire project coincides with the legislative policy of reducing the use of imported energy, lowering energy costs and improving pollution controls. Concentrated central business district growth would be encouraged with steam use, and there are opportunities for heating moderate income housing developments along the Mississippi with a hot-water project. Fraser thanked HUD and DOE for its support and leadership in this important area.

Concurrent Sessions: CITY PRESENTATIONS

Large Cities, Wyndham Clarke, Moderator
Dayton, OH
Atlanta, GA
Columbus, OH

Patricia Roach, Dayton, OH

Patricia Roach, Senior Council Member, began this session with her discussion of district heating (DH) progress in Dayton, OH. A review of Dayton's assessment demonstrated positive findings. Dayton has the right technical situation to convert easily to DH and the capabilities to use cogeneration for commerical and residential areas with modest retrofits.

The economic and financial aspects of Dayton's assessment appear favorable. Benefits of the system included energy cost savings, utility business opportunities, improvement of the city's infrastructure base, and increased community and economic developmenet. In addition, minority and lower to middle income housing would benefit if the project receives HUD loans. In this way, DH would provide and retain jobs and keep money flowing into Dayton. Since Dayton is a gas dependent city, the economic feasibility of DH looks continually better as gas prices climb.

Dayton has yet to put its plan to work. The short term revenue hurdle is the one major economic/financial problem in planning the sytems. Dayton's next step will include building a customer constituency, building city cooperation, settling ownership arrangements, and completing a detailed feasibility study and preliminary design.

Angie Leighton, Atlanta, GA

Angie Leighton represented Atlanta, the most southern of the 28 cities, so there is a need for district cooling as well as district heating.

The first item on the district heating and cooling (DHC) assessment agenda was mapping potential users. The project team mapped the city into three major areas of high density heating and cooling use: Area A: School-government-institutional users, Area B: Industrial and some commercial users, and Area C: Commercial-residential users.

The team determined Area A to be the best place to start a system which includes the Peach Tree Center, the World Congress Center, the

State Twin Office Towers, the south central business district, two public housing projects and a redevelopment area.

The second half of the assessment involved mapping heat sources. Atlanta has an existing steam DHC system owned by Georgia Power Company, which serves about 100 customers in a 5 mile area close to area A. The preliminary assessment determined the existing plant and system would be the probable heat source for a future system.

The Atlanta assessment team viewed public support as a crucial element in the success of a proposed DHC project. The team produced a colorful brochure which was distributed to utility customers to gain more public support.

Ms. Leighton stated the outlook for district heating in Atlanta is good and future progress toward a DHC project is expected.

Roger Sorey, Columbus, OH

The summary of the Phase I assessment for Columbus, OH, was not very optimistic, according to Roger Sorey. Columbus is now heated primarily with natural gas. Existing DHC systems serve Ohio State University (OSU) with hot water and serve a section of the downtown area with steam. Columbus lacks areas of heavy industry or other high density use. Therefore, the need for DHC is not as great in Columbus as it is in other cities in the 28 Cities Project.

Columbus targeted three areas of the city for study. All three areas overlapped the downtown area. Moreover, the most favorable area for the project contained the highest density of potential users. The area also contained coal-fired plants and OSU with its current heating system. The preliminary estimate of capital investment for this area would be $200 million. Keeping the current natural gas prices for Columbus in mind, the study showed that a conversion to DHC would not be economically sound in the near future. By 1995, however, with an 8% annual rate increase in natural gas, DHC would be competitive in Columbus.

Since natural gas and electricity are still relatively cheap, Columbus does not plan to implement or to market a DHC system in the near future. If industrial development or large rate increases in natural gas or rate increases in electricity occur, Columbus will reconsider DHC. At this time, Columbus does not believe DHC to be an economically sound investment for a capital-intensive system.

Concurrent Sessions: CITY PRESENTATIONS

Small Cities

Bellows Falls, VT
La Grande, OR
Devils Lake, ND

David Raszmam Bellows Falls, VT

David Raszman represented Bellows Falls, Vermont, a city with a population of 5,500 in the southeast part of the state, 100 miles north of Boston. In describing their current system. Raszman explained that it is not a true district heating (DH) system, but rather a low temperature geothermal unit that serves one building in the downtown area. The heat supplied, however, is vital during the long winter months. Investigating the municipal well which forms the basis of the system the city found that the ground water temperature was high, at 66°F rather than the average 47°F. The well is now linked with a heat pump in a revitalized railroad hotel across the street. The city has a large power plant that was used for water storage, and the warm water was pumped into a aquifer below the town. However, the plant was old, and it ran on oil.

HUD was not interested in financing the geothermal system but preferred the conventional oil system. However, the city saw the project as a way to integrate energy development and city revitalization; consequently, the Vermont Housing Finance Company agreed to fund the project.

The hotel required substantial rehabilitation and the energy system installation costs were high but the payback is expected in four years. The upgraded system met the high standards of conservation set by the community. The system pumps water at 180 gallons/minute and heats 10,000 square feet of senior housing and retail space in the rnovated hotel. The water circulates at 135-138°F and each room is regulated by thermostatic controls. The water is then discharged into a canal. The system can also provide air conditioning in the summer.

The renovated hotel has served as a model for and a catalyst to energy development in the rest of the community. HUD has taken a look at this successful groundwater system, and is now considering the possibilities of cogeneration annd a higher-temperature geothermal system. A three year program is being developed to subsidize loans from banks, to establish rapport with property owners, and to work on energy conservation. The city is currently studying the well to find out if the hot ground water in the aquifer

comes from the Connecticut river or from a fault line.

Michael Giddings, Union County, La Grande, OR

La Grande, Oregon, a city with a population of 11,000, is studying the use of geothermal resources, which are plentiful in the west. A fault line runs under the city and artesian wells pump 300-400 gallons/minutes at 85°F. In addition, eight miles away is a hot lake which was developed as a resort in the late 1800's. The lake's distance from the city, however, would make piping prohibitively expensive.

The city's assessment first outlined district to determine the heat load. These included a college, a hospital, and a residential area. Based on information from tax assessments, the city sought to recruit the owners of 942 buildings to use the geothermal system. The city ran into problems trying to convince the downtown merchants that the plan was feasible. The buildings are all old, of the 1920's era, and the merchants want the pipes laid and proof of the system's cost-effectiveness before they agree to use it. Educational programs are now being initiated to convince the merchants of the project's worthiness.

The college, hospital, and other institutions are already interested in using the geothermal resource. The city hopes that the system will be instituted in these buildings by 1985, and that the system's success will convince the downtown merchants to sign on as customers.

La Grande is currently studying the methods that Boise, Idaho used to finance its geothermal heating system. The city is considering a tax on heat, like a gas or fuel tax. Financing is available, and some engineering groups are interested in drilling wells closer to the city to cut distribution costs.

Stephen Zaiser, Devils Lake, ND

Steve Zaiser talked about a district heating system in Devils Lake, North Dakota, a town with a population of 7,500. Until 1974, seventy (70) customers in the downtown area were served by a low-pressure steam system. Due to environmental problems with coal, however, the Otter Tail Power Company abandoned the DH systems, forcing the city to fall back on its own resources. Legislation then created the Steam Heat Authority as an autonomous organization. The authority runs the Devils Lake system with natural gas and oil as a backup. Using gas as a fuel caused heat prices to increase. To lower costs,the City studied the feasibility of changing the fuel source and expanding the system. This study found that municpal waste was the most economical fuel when compared to peat, agri-waste, and coal,

as well as the presently used fuels.

Using grants from HUD, the city developed a three-year comprehensive plan which included converting some of the buildings to the system, including a senior housing project and a day care center. Several different expansion schemes were considered. Among them a public school and a junior college, located a mile away, could also be added to the system.

After ten months of study, the Steam Heat Authority was ready to begin construction. The project required $2.4 million. To fund the project, $300,000 was received from an Innovative Energy Grant, $500,000 from UDAG, and $1.6 million in revenue bonds. Financing difficulties, however, caused a delay in construction. The Steam Heat Authority then sold $2.4 million in temporary construction notes which would, at a later date, be taken out by the federal funds and the sale of tax exempt revenue bonds by the Devils Lake Steam Generation Corporation. Ultimately, using what is called 63-20 financing, the Steam Generation Corporation will sell permanent revenue bonds, own the plant, and contract operation out to the Devils Lake Steam Heat Authority. Interim-interim financing was used when the Authority borrowed from a local bank prior to finalizing interim financing.

The plant is now under construction. It will be using municipal waste as its principal fuel with agri-waste as a peaking and supplementary fuel. The incinerator capacity is about 112 tons/day while only fifty tons per day are now committed, 20-25 tons from the City of Devils Lake, and 30 tons from an outside hauler picking up from small towns in the area. The tipping fee will be $2.50 per ton for 1983.

Concurrent Sessions: Financing and Investment Panels

MUNICIPAL FINANCING PANEL
Ted Capus, DOE Moderator
Dean Finn-Carlson, Touche Ross and Company
Bob Pulscher, Springsted Corporation

Ted Capus

Ted Capus, of the Federal and Community Programs of DOE, introduced Dean Finn-Carlson from Touche Ross, and Bob Pulscher, the President of the Springsted Corporation.

Dean Finn-Carlson

Dean Finn-Carlson discussed the problems and possibilities that arise when a municipality finances the implementation of a District Heating and Cooling system. The first major problem is obtaining the financing. IDBs must be used according to the requirements of the IRS, however, IDBs may be difficult to market without debt-service guarantees structured in the rates or contracts. These bonds are limited to $10 million, or $20 million if the City receives a UDAG. Financing has become easier, however, since Congress passed the Senate Bill 2025 clarifying the tax exempt status of IDBs used for DH purposes.

Another major problem lies in assuring that the benefits of the appropriated IDB funds accrue to the community without becoming disputes, the DH System should be divided into its essential components and their individual owners should be specified. These four components are (1) the thermal source, (2) the transmission system, (3) the distribution system, and (4) the user conversions.

The thermal source is the most complicated component to finance. The use of municipal funds depends on the magnitude of the costs and on the source ownership. The Senate bill excludes the thermal source from tax exempt financing status under IDBs. However, if a municipality owns the thermal source, it can be financed with tax exempt municipal funds.

If an existing thermal source is being renovated, the $10 million ceiling on IDBs usually does not present a problem in covering the costs. New thermal sources which utilize fuels such as solid wastes, are eligible for tax-exempt financing and, can be covered by municipal funds as well. However, a thermal source which is being newly constructed and uses conventional fuels such as coal, the $10 million dollar IDB limit on financing probably will not be sufficient

to cover the building and start-up costs.

The second component, the transmission system, links the thermal source and the distribution system. Although the transmission system is capital intensive, it is exempt under the new tax law and is a good candidate for municipal financing. If the transmission system is publicly owned, the municipality typically controls the rates.

The distribution system or third component could be municipally financed. Expansion of the distribution system can also be financed in the form of IDBs, UDAGs (which may be difficult to obtain), private funds, or tax-exempt bonds.

Financing, the last component, the building or user conversions, can be a complex problem and depends on the type of system and the fuel sources. For example, converting a steam system to a hot water system can be expensive. If both the old and new systems use steam, however, the cost will be minimal. Two financing options for conversion costs are: (1) issuing an IDB, on which the owner and not the municipality pledges debt service or (2) using private funding, which may be paid back through energy savings.

Finn-Carlson emphasized that the new tax bill created exemptions for three components of DH: the transmission system, the distribution system, and the user conversions. Depending on the magnitude of the costs, the thermal source component could be covered by tax-exempt municipal financing as well. He also said that the new bill imposed no limitations on alternative energy sources.

Robert Pulscher

Mr. Pulscher is a financial advisor who has been involved in DH projects for 3 1/2 years. He listed high inflation, high interest rates and the extreme fluctuations in alternative energy sources as the intertwining factors causing difficulty in DH development. He stated that DH systems fall into three basic catagories: older systems with full depreciated generation, transmission and distribution parts, an inadequate revenue base and no investment possibilities; existing, not fully-depreciated systems that are expanding into new areas; and new systems using an alternative energy source. All of these systems face three major difficulties if they are going to grow. A system must be assured of a market, and the second problem is obtaining long-term user commitment. Finally, financing customer conversion costs is the third major difficulty.

To obtain tax-exempt funds for a privastely developed DH project, organizational structures must be change to create a general comunity-wide system. This is only possible if needs can be

demonstrated by a feasibility report, the project is viable and community-supported, and the revenue forecast predicts 100% coverage of operating and debt service costs. Without this general assistance, financing a DH system is barely possible.

General Obligation (GO) bonds are another source of financing if the rates for DH provide 100% of the operating and debt-service costs, reserves are adequate in case of losses, and the transmission and distribution systems are possitively assessed. Benefits of using GO bonds include easier customer contact since the system can demonstrate 125% coverage with the first year's revenues.

An outright loan at the beginning can expand the DH system to include community-wide assistance. Partial community assistance could be used to plan and conduct the feasibility study and cover the period when the incompleted system can not show coverage. The loans are repaid when the revenues and bonds are issued. Benefits of this assistance (credit rather than outright cash) include reducing the interest rates and investors' risks, saving 100 to 125%, eliminating the need for 125% coverage, reducing the bond issue size, and eliminating the need for reserves.

Partial GO support also reduces 60 to 100% of the marketing costs and the legal costs, and makes the project feasible. However, GO bonds require an early effort to involve the community and may adversely affect the community's credit rating.

Mr. Pulscher concluded with a forecast of market conditions. Interest rates will be lower than in the past 24-36 months; however, DH will be competing with the construction needs of America's infrastructure (bridges, roads, etc.). Interest rates should be less volatile than in the past which should make planning easier and less expensive.

PRIVATE FINANCING

John Millhone, Department of Energy, Moderator
Donald Dodge, Deputy Assistant Secretary, HUD
Daniel Harkins, CSI Research, Inc.
Anthony Carey, City of Baltimore Project

John Millhone

In his introduction, Mr. Millhone emphasized the importance of developing a DH contract that is mutually satisfying to all parties. He believes that private financing has the greatest potential of any form of DH financing.

Donald Dodge

The first speaker, Donald Dodge, Deputy Assistant Secretary of HUD, spoke on two topics: (1) funding sources for energy in general and how to use them, and (2) government funds as investments.

The first program Mr. Dodge discussed was the basic Community Block Grant Program.

Dodge reported that HUD's Office of Community Planning and Development has funds worth $4.2 billion. Of these, $1.1 billion is being used by localities for the rehabilitation of residential and commercial buildings. These funds can be used for retrofit and weatherization. Another $900 million is slated for infrastructure use. These funds could be used in conjuction with DH projects to lessen considerably the burden of DH financing. Dodge also spoke of the Section 1008 loan program which is a guaranteed loan with a budget mark of $225 million for fiscal year 1983. The program offers interest rates at about 4 points below prime rate. Mr.Dodge pointed out that the money is available this fiscal year but may not be available for fiscal year 1984.

Another available fund is the Urban Homesteading program which makes available $12 million for federally owned homes. In this program, homes are sold for a nominal amount of money with a contract that requires the buyer to renovate the home in a given time period and live in the home for a given number of years.

Dodge also spoke about the popular Urban Development Action Grant program which has funded many projects for alternative energy. The UDAG program is competitive with four large city and four small city competitions per year.

Regardless of the source of funds Dodge urged people involved with DH or any other program for that matter, to treat any funding as an investment. He warned them not to give money away, but to use it as seed money to form joint ventures. To get the most for the federal or local dollars, government funding should be used to promote public and private partnerships.

Daniel Harkins

Daniel Harkins discussed the financing of Waste-to-Energy (W to E) systems. A W to E system has five components: public waste supply, private waste supply, waste facility, landfill, and energy market.

There are many incentives for developing a W to E system, including a stable, long-term energy supply that is competitive with present fuel

costs in the energy market; a stable, long-term waste disposal; and an opportunity to design, build, and operate the waste facility at a profit. The potential benefits for using W to E systems with DH are: avoided direct investment in the production facility by the users, sharing of system costs by users of the disposal service, production risks assumed by the vendor, and lower energy costs.

Mr. Harkins discussed two types of ownership for W to E systems. A publicly owned system would finance 100% of the construction costs with bonds. The risk is shared by the energy market, the vendor, and the public. With a privately owned system, the owner finances the construction costs. The privately owned system can derive some tax benefits. A 10% investment tax credit, depreciation, and possibly a portion of the energy tax credit are available.

In conclusion, Mr Harkins stated that an ownership choice must be deliberately made and the public's ability to develop the project may limit the ownership choice. Under any ownership structure, a city can obtain low cost energy and a new capital plant by using W to E in district heating.

Anthony Carey

Anthony Carey, an attorney involved with the Baltimore Project, gave a detailed analysis of how Trenton, NJ, financed their district heating system. Trenton started with a privately owned dual fuel-fired cogeneration plant that serviced a 4 mile downtown loop. Twenty-year thermal and electric contracts were signed with twelve state office buildings and one hospital in Trenton. In this project the electric contracts are comprehensive and include rate increases. The thermal contracts, however, do not regulate the rates. The total financed cost was about $34 million. Carey's breakdown of the financing includes:

14	million	tax exempt (Industrial) Development Bonds
11.5	million	leveraged lease (boilers-generators
4	million	UDAG
0.4	million	DOE
0.5	million	user deposits
2.3	million	investment income
1	million	equity contribution from investors
33.7	million	

10:30 A.M.

Concurrent Sessions: CITY PRESENTATIONS

COGENERATION ENERGY SOURCES

Norman R. Taylor, Moderator
Holland, MI
Springfield, MA
Provo, UT

Norman R. Taylor

Norman Taylor opened the panel by defining cogeneration as combined heat and power. Cogeneration originated when early electrical systems produced excess heat which was later harnessed to heat more than the immediate area.

Pieter Dekker, Holland, MI

Holland, a city with the population of 26,000, began looking at cogeneration in conjunction with their community revitalization program in an effort to halt the deterioration of the business core and housing district. In addition to economic development, cogeneration offered a profitable alternative to the existing system of expensive gas-fired boilers.

Holland's first phase of the cogeneration assessment began with the identification of heat sources, which included:

-two industries (boilers with year round production processes) Heinz and Parke Davis
-a college complex
-a city power plant (including an idle coal fired turbine/generator unit.)

Potential heat loads and back-up services were also identified. As momentum grew, the idea of a cogenerated DH system was received enthusiastically and letters of interest were signed to indicate community support. Additional considerations were the high conversion costs and the replacement of the turbine and condensor with an extractor/backpressure unit. This unit will be equipped with an electrostatic precipitator for compliance with EPA regulations.

Holland's second phase, the expansion phase, would include serving the hospital and school zones. Institutional and legal barriers were minimal, possibly due to good public relations campaigns and community involvement.

The load analysis assumed 135 million btu/hr load or 321 x 10^9 BTU annual load. During the Phase I development, the total energy use for the system was estimated at 175 million btu/hr peak load, or 619 x 10^9 btu/yr. Consequently, the turbine [213 million btu/hr] generator is capable of meeting the requirements of both Phase I and II development.

The total cogeneration capacitiy per year was estimated at 29,123 MWH. The capital expense of the project was broken down into $2.8 million for electrical cost and $11.5 million for thermal heat. The electrical side comparison includes a savings estimate of $.036/kwh or $1,000,000 by 1984. The thermal side comparison included $10 per million btu savings on the gas fired boiler compared to the $7 per million btu on the coal-fired by 1984--these savings resulted in a $1,000,000 savings to the customer by 1984. These figures include summer peaking loads and condenser return.

In answering questions, Mr. Dekker explained that the rationale for the turbine and condenser replacement was the manufacturer's recommendation. He said rates for high and low pressure service would not differ. In response to how much electric generating capacity is lost due to taking out steam, Mr. Dekker replied that no losses result. When asked whether the option of incremental capacity had been considered, Mr. Dekker said that it had, but that cogeneration was still cheaper and produced more KWH than conventional generation.

Joseph Superneau, Springfield, MA

The city of Springfield's project began as a joint venture with Springfield Center, a non-profit organization which encourages economic development. The city has a municipal electric utility (200 MW) with two small DH systems downtown. The heat source analysis prepared during the project found there was waste heat potential from existing turbines and cogeneration would improve some turbine's efficiency from 30% to 60%. The city also looked at the use of methane generated from water treatment and landfills.

A load survey of individual buildings was conducted and load projections of 30 MW were found in the business district. The practice was strongly recommended for other cities by Mr. Superneau.

Springfield development plans included as assessment of the turbine efficiencies with modifications of the turbine occurring in the third year of the system's phased growth. Until the second or third year, the heat would be supplied by the refuse plant or by high temperature hot water boilers.

Problems encountered by the city included Massaschusett's recent Ominibus Construction Act, which delayed engineering construction projects 3 to 4 months. Also, the load demand of the downtown core areas did not match energy sources. The 20-100 MW energy demand necessitated a service expansion, and a third turbine would be required rather than tapping into the second turbine.

In conclusion, Springfield found the project a feasible investment, especially with the utilities' interest and cooperation. They anticipate that the DH system will also minimize future environmental problems.

Garth Lindburg, Provo, UT

Representatives from Provo's municpally owned utility entered the DH movement with few pre-conceived notions, which they claim was an advantage.

The municipal utility expects the need for a new source of electric power by 1987, and is considering a purchase of a coal mine.

Provo is investigating a hot water system that will serve the university, a high school, a hospital and housing for the elderly. The current electric system serves over 20,000 customers, has two steam boilers (coal and natural gas), four steam generators and a diesel for peak use. New system projections would use the existing plant and include a waste-to-energy system and expansion to serve a hotel and shopping mall.

In addition to user and popular support, the city has obtained the financial committment to enter Phase II.

REFUSE SOURCES

Andrew Euston, Moderator
Baltimore, MD
Gary, IN
Lawrence, MA

Sheldon Lynn, Baltimore, MD

Mr. Lynn stated that the Baltimore Project will be cutting the ribbon on their new district heating system by November 1985. The 2000 ton incinerator will produce 50MW and 300,000 lbs. of steam. Baltimore has a large population of poor, estimated at 150-200,000 who will suffer as gas and oil prices rise. Therefore, the DH system serves an important social function. Baltimore's goals are to complete a DH system to provide thermal energy to the low income housing in the city.

The city's first approach to DH failed because the planners relied on colleagues and consultants with limited understanding of the technology. The city questioned the plan's viability when it proposed a 50MW coal-burning unit costing $100 million.

This plan was abandoned, and the city hired Resource Development Associates to rescue the study. Financing the DH system was a key issue, and the city sought a system based on users prepared to sign 30 year contracts with institutions rather than industries.

The area selected for development is the Cherry Hill area of Baltimore. The benefits of the plan for this area include:

Possibility of lowering the tipping fee by $3 to $4/ton
Solving the problem of heating public housing units
Reducing the air quality problem
Causing greater economic development

Baltimore is concluding Phase I. With $6 million from HUD, the incinerator will be rebuilt. Sheldon Lynn believes that planners need the advice of experts when studying or building a DH system. Also, he hopes to see a reverse in the present incentives favoring gas and electricty so that the U.S. can develop an integrated energy system like those in Europe.

Margaret Merhoff, Gary, IN

Margaret Merhoff explained that one of Gary's major problems is trying to sell the public on the benefits of a district heating system to a city where unemployment is over 20.1% and over 50% of the

residents have low-to-moderate incomes. So far the feasibility studies seem to indicate that district heating is economically feasible.

Merhoff noted that strong mayoral support is essential if district heating is to be implemented. In Gary there had been a district heating system provided by U.S. Steel in the 1920's, but the system had been abandoned years earlier. However, because of the economic development potential and rising utility rates, the city began to reinvestigate district heating. Ultimately, the major thrust for a DHC project would be downtown which contains a hospital district, several schools, public housing for senior citizens, commercial development and various municipal buildings.

The Phase I analysis drew upon the expertise of 39 community leaders including representatives from U.S Steel, a local bank, the local utility company, local businesses, and government organizations. These would give a potential system a base of support. Numerous potential heat sources and various customer configurations were considered. Ultimately, municipal waste was identified as the most promising heat source.

The potential use of municipal waste as a heat source of district heating could solve two problems for the city of Gary: increasing difficulties encountered in disposing of municipal refuse and rising utility rates. However, the use of municipal waste in a DHC system does create other problems. The potential thermal energy available from the refuse far exceeds the thermal customers. There is also a potential environmental problem because Gary is a non-attainment area. The Phase II analysis will help resolve these and other issues such as classifying the waste, determining a specific site for the DH plant, and gaining public support for the project.

Merhoff stressed that the key to a successful program is the citizen's participation. Gary bussed people to Chicago to see the DH system there and to gain a better understanding of its benefits and simplicity. This was a very useful method and Merhoff recommended it highly. Merhoff was hopeful and said that Gary shows potential which can be fully explored in Phase II.

Kevin Clement, Lawrence,MA

Lawrence, MA covers 6 1/2 square miles along the Merrimac and has a population of 103,000. Lawrence uses oil for 75% of its energy but burns 2.5% sulfur, in conflict with stiff pollution controls. High energy costs and a concentrated high population there provide strong incentives to develop DH. Also, since Lawrence uses such a large amount (37%) of energy in comparison to the rest of the state (16.1)

the DH project soon became a high priority for the city.

The potential suppliers for the system were General Electric, Merrimac Paper Company, Lawrence Paper Board, and the Arlington Mills Powerhouse. General Tire was also a potential supplier, but that plant is currently for sale. The Arlington Mills' Powerhouse is the favored energy source. Industrial use served is an incentive to increase the plant's output. The majority of the users need space heating only.

Funding for Lawrence's DH Project includes action grants and an unsolicited loan from the bank of $3.5 million was made available but not used.

The plan's benefits include less pollution, lower energy costs, and a stabilized energy supply. Also, money will be kept in the community. Since the city owns part of the plant, it will receive additional revenues.

LUNCHEON SPEAKER
Stuart Sloame, HUD, Introduction
Katherine Sasseville, Otter Tail Power Company

Stuart Sloame

Stuart Sloame, Deputy Assistant Secretary for Community Planning and Development, welcomed the participants and introduced Ms. Sasseville. In his remarks he noted the progress that is being made in district heating with the assistance of HUD's Phase I grants, with the assistance of Minnesota's own feasibility grant program, and through other independent efforts. He announced that HUD had selected three cities, Baltimore, Lawrence, and Provo to received Phase II assistance (intensive design and financial packaging.)

Mr. Sloame urged the cities that have identified technically feasible projects to concentrate on their impact on the city's community and economic development objectives as they increased their efforts to broaden their base of local support and line up customer commitments. He indicated that both HUD's basic community development block grant program and the urban development action grant program were important development tools cities could use in district heating projects. He noted that two of the three cities winning Phase II assistance had given public housing projects a prominent consumer role in their project plans.

Sloame was particularly complimentary about the extent of success of the public-private partnership arrangements found in many of the Advisory Working Groups (AWG) constituted by Phase I cities to serve as a combination steering committee, technical advisor, and proponent for the district heating project. He urged all cities present to explore fully the AWG's potential if they had not done so. He strongly supported the private sector's role in developing DHC systems and pointed out that the American private sector through its manufacturer was fully capable of meeting all of the hardware needs of U.S. district heating systems.

In closing, Mr. Sloame urged all the cities not to be lulled into a mood of energy complacency by the recent easing of the OPEC oil situation. He suggested that we have been given a little more time and a little breathing room to continue the effort to assure cheaper energy prices in our cities.

Katherine Sasseville

Ms. Sasseville, a former member and Chairman of the Minnesota Public Utilities Commission, spoke on the functions of the Public Utilities Commission and its relationship to DH cogeneration systems.

Two primary tasks of the Commission are to insure that:

-total revenues are neither inadequate nor excessive

-neither discrimination nor preferential treatment in the form of cross subsidization occurs between classes of customers.

District heating presents special problems for the PUC in cost allocations between traditional regulated utility services and either regulated or unregulated DH services. Initially, few customers and high front-end costs require below-cost pricing in order to be competitive. PUC's are not used to pricing for competitive markets. Therefore every preliminary attempt to educate PUC.s to the need for nontraditional costing and/or regulation should be made. The effort should be to prevent potential conflicts with regulators, or to anticipate inevitable conflicts and solve them through legislation or other means before the economic die is cast. If the project involves cogeneration with a regulated electric utility, it is imperative that the commission's cost allocation methods be known early on in the project and that they produce an economically viable cost for the DH enterprise. The rates that customers arepromised must be based on that assured cost allocation or the project is highly susceptible to failure.

Preferential treatment is an especially difficult problem since traditional regulatory theory requires that all customers pay the same price for a service. The economics of the project, however, may require that early signing customers receive preferential contracts rather than using uniform tariffs. The goal should be to avoid the restrictions of traditional regulation insofar as possible, both through educating the commissions to creative alternatives such as contracts instead of tariffs, and through corporate management strategies. These might include, for example, a separate subsidiary for distribution or lease-back arrangements for large capital items.

DISTRICT HEATING IN MINNESOTA

RETROFIT OF A STEAM HEATING SYSTEM TO HOT WATER

Michael Nitchals, Controller and Acting Assistant General Manager of the Willmar, MN, Municipal Utilities Department, Willmar, MN

Michael Nitchals

The Willmar's original steam system, built in the 1920's, had heat losses of as high as 50% due to leaking pipes. These leaks also caused deterioration and corrosion of the distribution system. This original system had to be replaced or abandoned. Consequently, a new hot water district heating (DH) system was installed that included leak detection systems over joints and extensive joint covers (welding, foam insulation, and jackets). In addition, a heat conversion station (steam to hot water) was designed. The system's loss rate now is approximately 7%.

Willmar considered three options in the feasibility study; 1) a new steam system, 2) a hot-water system, and 3) abandon the district heating system. Decisions were made based on the cost effectiveness of each option. The natural gas and hot water option was less costly (including building conversion cost) than the steam for the first few years. When gas prices rise appreciably, as predicted in the near future, then the DH/hot water system will be most effective.

Willmar is the nation's first municipally owned hot water system. The city attributes some of their project's success to five-year loans at 12% to building owners from the housing authority, a $2 million bond issue successfully sold, and a profitable utility profile.

The system costs over $1.3 million for the distribution system, $400,000 for the conversion station, and $175,000 for the engineering. All shut-offs for the Willlmar system are in buildings or isolation units. The customers financed their own conversions. Willmar has since received a $20,000 grant to study the expansion of the system. Currently, consumer rates are set at 2.5 cents KWH for hot water and $7.25/thousand lb steam.

Willmar's project was constructed in conjunction with the urban redevelopment plans and civic renovation. The system was completed and began operation in late September, 1982

In response to audience interest, Mr. Nitchals replied that they floated their own general obligation bonds rather than state bonds because their financial consultants showed that general obligation

bonds were more advantageous.

DESIGN ALTERNATIVES TO ATTAIN FINANCIAL FEASIBILITY

Jim Powers, Metcalf & Eddy Consultants, St. Paul, MN

Jim Powers reported that the St. Paul project resulted from the local utility's need to replace an aging steam system. After evaluating DH's success in Europe, the group began to re-examine district heating. Renovating four heat sources was considered in the preliminary report. A decision was made to base the piping design on the European model, and the "cut and cover" method would be used with composite pipe. Additional unique features of this project were the fixed lump sum bid and no-phase growth. The lump sum fixed bid required an unusual construction contract containing contingency clauses in the bid. Another alternative was to bid with the manufacturer's plan and suggest alternate designs. Other point of interest included a phased loop design, with the first large branch looped initially rather than smaller loops expanding outward during the design phase.

One of the obstacles encountered was the complex utility arrangement, especially since relocating the utilities can be enormously expensive. For instance, relocating one electric line in an intersection would have cost $5 million, and in one intersection alone 31 manholes were counted. In addition, the aerial survey caused complications in trying to determine the best piping route. Consequently, Mr. Powers does not recommend using aerial surveying. A detailed soil study was also done to help eliminate unknowns for the bidders, since the lump sum bid method was used.

Bidding procedures were complex and required an extensive effort from contractors, one of whom estimated his bid cost at $100,000. The factors which affected a favorable bid were the contractors' slow market, the time allowed for bids (9 weeks), the decision to put out a large project, and the advertised qualifications.

Sixteen bid packages were requested and five bids were allowed. The contract restrictions required contractors to assume the risks of not meeting the schedule since they would be required to provide temporary heat to building owners if the system was not completed on time.

Mr. Powers pointed out the following recommendations based on the St. Paul project:

- put out a large project rather than several small projects

- leave spare capacity in pipelines

- obtain cooperation from utilites
- use common components where possible
- link pipe laying with street and utility renovation schedules
- encourage builder-owner involvement
- give bidders time to make most cost-effective decision
- use ground rather than aerial survey

DISTRICT HEATING AND INDUSTRIAL DEVELOPMENT

William Lundy, Project Developer for Bagley Industrial Development Corporation and President of Ecological Industries, Bagley, MN

William L. Lundy

Bill Lundy stressed that district heating (DH) was a spur to local development and a solution to Bagley's pollution problem. He discussed fuel resources and customer base expansion, two important parameters in Bagley's district heating (DH) system. The high cost of fuel (#2 oil) and the buildup of wood residue from local sawmills were incentives to build a system which used this residue as a thermal source. A successful feasibility study was conducted by the Minnesota Energy Agency and the Touche Ross Company. Bagley developed an active marketing program to attract industry and expand the DH customer base. A modular design allowed for future expansion.

To insure continuous ownership of the DH system, the Bagley Industrial Development Corporation was created. Bagley's Mayor formed a liaison between the corporation's board and the city council. Financing of the DH system is currently under analysis. In a small town like Bagley, state and federal funds are essential.

Mr. Lundy talked about DH as a strategic consideration. The United States should look at the long-term consequences of energy development as a strategic concept and its effects on economic development and national security. By using DH to conserve energy, more fuel would be available for other uses, for example, to run farm machinery in Minnesota.

CITY PRESENTATIONS

Bernard Manheimer, HUD, Moderator New York City, NY
Norwalk, CT
Ecorse, MI

Richard Kuo, New York City

New York City has researched several innovative approaches to district heating. New York needs district heating to help alleviate its $8 billion energy bill, 70% of which goes to spare heating. Some of the city's older buildings that are supplied with district heating were studied, and in three out of four the options considered were hot water systems.

Institutional problems arose with three district heating project areas. The first in Central Brooklyn would involve modernizing a boiler and making the interconnections. The area studied includes the Kings County Medical Complex of four hospitals and 27 buildings. The main obsticle was convincing this complex to spend more than $7 million in retrofit costs.

The second project under consideration was an incinerator in Southwest Brooklyn. This facility burns 1000 tons per day with the potential of supplying a cogeneration plant producing both steam for district heating and electricity. The site has a good location near a large housing project. It would be necessary to add an electrostatic precipitator for pollution control at this site. There is a large nearby housing project, but no official commitment has been made as to its use of district heating.

The third site, the Brooklyn Navy Yard, has the most potential as it contains a 261 acre industrial park, 12,000 housing units, a power plant and five piers. Presently supplied with district steam, the high cost caused a $1 million loss. There is no current push to make the area energy self-sufficient. A $5 billion loan to the Navy Yard Development Corporation for developing and researching the project brought to light several potential problems. For example, the Public Housing Authority units are publicly subsidized and would not be allowed to retain any funds saved by lower energy costs. Additionally, some insitutional risks must be considered if service from the Consolidated Edison Company of New York is discontinued. Overall, however, the Brooklyn Navy Yard project was considered feasible and should be continued.

Heather Rodin, Norwalk, CT

Norwalk's district heating (DH) system would be cogneration. Using

waste heat from two electrical plants, the plan would provide heat for the inner core of the city. The steam loop would cover the hospital, YMCA, and a chemical plant. The hot water loop would service commercial areas, residential areas, and housing for the elderly.

A new mayor increased the focus on the project. The news coverage of DH at this point was minimal. After an all day conference on waste to energy and its use in DH systems at which the mayor was a keynote speaker, the project received more news coverage. Waste to energy DH has now become a more controversial subject and more of Norwalk's public is aware of it.

Mary Jane Hock, Ecourse, MI

Ecorse had several major existing economic problems prior to looking into district heating (DH) including: a 30% unemployment rate, one-third of the land is owned by Great Lakes Steel, and the loss of production jobs. All of these factors showed the city's economy declining, and the need to become less dependent on the auto and chemical industries and to bring in more non-manufacturing industry.

A 16 city consortium met to solve small city problems in a regional manner. There was no publicity and no money for the program at the time. However, at this consortium, DH was found to be a viable tool for encouraging economic growth.

KEYNOTE SPEAKER

James L. Oberstar, Congressman for the 8th District, MN

James L. Oberstar

Mr. Oberstar commented on how the success of the St. Paul district heating project contrasts with the headline from a recent Washington Post that stated:

> "Synfuels dealt with new setback, SOHIO to drop out of major project, cites poor return." The story went on to say, "Sohio Corp said yesterday (Wednesday, October 20) it has decided to drop out of a major synthetic fuels project, writing off millions of dollars invested in the effort and adding to the doubts about the near future of synthetic fuels development."

SOHIO's decision followed a similar decision by Exon Corporation to write off hundreds of millions of dollars invested in an oil shale project. While neither Exon nor SOHIO had requested government assistance, their partners had expected to receive funding from the Synthetic Fuels Corporation.

The consequence of these decisions are that the Synthetic Fuels Corporation has money to spend, but no viable project to fund, and present law limits eligibility to the kind of project that made SOHIO and Exon wary.

Mr. Oberstar wants to enact legislation which will give the Synthetic Fuels Corporation worthwhile, capital conservation projects to fund instead of economically questionable and potentially environmentally dangerous synthetic fuels development. He would like to see the Corporation in the position to provide communities with the money to develop energy efficient, clean, economical district heating systems such as the St. Paul Project.

Mr. Oberstar, with his colleague Congresswoman Claudine Schneider, has introduced legislation, H.R. 5833, that would give the Synthetic Fuels Corporation this authority. Their bill represents the products of extensive deliberations of the Northeast Midwest Congressional Coalition and of two hearings held last year, working closely with the U.S. Conference of Mayors and with district heating and resources recovery organizations throughout the nation.

The purpose of the legislation is to:

> Broaden the lending authority of the Synthetic Fuels Corporation

to include district heating and cooling. These projects would be eligible for all forms of financial assistance available from the Corporation.

Amend Section 132 of the Energy Security Act, relating to loans made by the Synthetic Fuels Corporation, by adding a new section--Section 132a--authorizing price support loans for municipal waste to energy projects.

Stipulate and require that 25% of the financial assistance available from the Synthetic Fuels Corporation be directed to district heating and cooling and municipal waste to energy projects.

Require the Board of Directors of the Synthetic Fuels Corporation to assure that the Corporation is organized and staffed so as to effectively evaluate, process and review applications for district heating and cooling and municipal waste to energy projects.

District heating and cooling systems have been getting increased attention in these days of energy conservation and "appropriate energy technology" particularly in the district and state Mr. Oberstar represents. Minnesota is the home of some of the oldest systems in the nation. His home area, the Mesabi Iron Range, has some of the largest residential systems in the world. In Virginia, MN, 90% of the commercial district and 75% of the residential are linked to the community's system. Virginia claims the largest number of metered customers of any district heating system in the world.

District heating development was slowed by the decade of cheap oil and gas enjoyed during the post-war decades until 1973. The continuing increases in energy prices have forced a revival of interest throughout the country in district heating.

From the standpoint of energy cost and availability, communities with district heating systems will look particularly attractive to industries, businesses, and families that need reliable sources of heat, electricity, and cooling.

District heating and cooling also offer the prospect of stabilizing heating and cooling costs through its broad-based distribution of costs. Only 25% of the annualized cost of DHC is in fuel costs; 75% is in capital costs. This suggests that fuel price inflation will be less of a factor in future energy pricing for district heating and cooling customers than for other systems.

Mr. Oberstar stated that the Synthetic Fuels Corporation should be

broadened to include energy options applicable to all regions of the country in order to spread out this much-needed investment capital. The entire Northest-Midwest is virtually eliminated from consideration in Corporation spending decisions and such regional discrimination will only strengthen growing opposition to the Corporation.

There are benefits for states interested in developing district heating and cooling systems. If district heating was developed in all Minnesota communities over 5,000 people, the total heat delivered by the year 2000 would be 44 trillion BTUs per year, about 3.5% of the state's projected primary energy demand in the year 2000. Since about 60% of this would be cogenerated, the heat would be produced by fuels also used to generate electricity, saving 28 trillion BTUs of energy per year, equivalent to 200 million gallons of oil per day.

Mr. Oberstar questioned why isn't every city in the United States scrambling to convert to district heating? He cited the high costs of financing these projects. The assistance provided through the Synthetic Fuels Corporation would mitigate financial impediments and promote development of these innovative energy technologies. As a matter of public policy, government has a responsibility to stimulate the development of initiatives like district heating.

Concurrent Sessions: INVOLVEMENT OF LOCAL UTILITY IN DISTRICT HEATING

UTILITY INVOLVEMENT

Clement Crooks, Moderator
Ishai Oliker, Burns and Roe, Inc
Anthony Mirabella, Hartford Steam Service Company
Ronald McIntyre, Detroit Edison Company
Charles Fricke, Virginia Municipal Power Company

Ishai Oliker

The utilities which are most receptive to district heating are often privately owned and/or coal burning. A primary consideration is the cost difference between fuel burned at the power plant and fuel cost to individual customers.

The cost of heat alternatives may include basing price schedules on operational mode, considering heat load schedule rather than electric schedules. It is important to assess the utility dispatch mode and to bring on peaking sources in order to provide flexibility and avoid penalties such as capacity charges. Further planning is of great importance.

Regarding the retrofit of an existing power plant, it is important to work with the utility and the manufacturer to reduce cost

In order to reduce utility risk, it is important to develop a phased load growth scenario. It is appropriate to use the EPA model to establish emission reduction.

Anthony Mirabella

Mr. Mirabella stated that in Hartford the electric utility was not favorably inclined to the idea of a DH project since it represented competition. As gas and oil prices rise, however, electric utilities may look more favorably on DH. Diversifying heat sources to minimize regulation may further attract the utilites to DH.

Hartford Steam Service Company's role in the project included marketing the program by alerting developers and potential customers to the advatages of DH; designing a distribution system; and locating waste energy plants or other energy supply.

Ronald McIntyre

Detroit Edison is an electric utility with a DH system owned since

1903, which is 3 miles long and serves 700 customers. These customers include a university, medical school and government buildings. The utility recognized a cost inefficiency due to their natural gas fuel, management problems, and restrictive regulations.

Since 1974 the utility has been negotiating with the city regarding a waste recovery system. There is a good possibility that construction of this facility will begin in 1983. Other parameters for the utility's consideration are the need to return to coal to be profitable.

Examples of areas for cooperation include the reduction of taxes to be more like commercial property; reduction of sewage charges on water used for steam, and prompt repair of water mains.

Charles Fricke

Virginia, MN, is a municipal utility with 64 years of experience in the DH realm. Their system was built in 1919 and hooked up 40% of the town by 1940. Their cogeneration plant uses coal to produce steam and they attribute their ability to produce cheaper electric to cogeneration.

In Fricke's opinion, the relationship between the utility and the city is the single most important factor affecting the success of DH projects. An important element of success is that the city should not consider the system as a revenue source, instead the utility should keep funds and use them for upkeep.

Examples of important synergistic relations with the city are:

- peat and wood development
- municipal refuse
- storage capabilities (Purpa 212)
- sharing equipment (street crews)
- computer billing
- joint trenches (renovation & reconstruction) from general funds.

PANEL ON REFUSE ENERGY

David Gatton, Moderator
Lewis Cohen, CSI Resources, Speaker
Michael Gagliardo, Baltimore, MD, Speaker
William Hanselman, Resource Development Associates, Speaker

Lewis Cohen

The first speaker, Lewis Cohen, Senior Associate of CSI Resource Systems, Inc., discussed the use of Waste-to-Energy (W to E) systems in conjunction with district heating (DH) systems. Dr. Cohen said that, because of economic considerations, a DH system provides a good market for W to E systems under two conditions: (1) if the area is dependent on an oil or gas fuel source, or (2) if the area is considering investing in a new coal-fired system. Energy costs can be reduced with a W to E system in either case. The potential benefits of W to E systems are: (1) new production investments by the DH system are avoided; (2) production risks are assumed by the full-service vendor; (3) W to E system costs are shared with disposal service users; and (4) energy can be supplied at a lower cost than with fossil-fuel alternatives.

Dr. Cohen then discussed several characteristics for systems that influence the compatibility of W to E and DH. For example, to meet disposal requirements, a waste-fired facility typically must operate at a constant level. For this reason, waste-fired boilers are not well suited to varying load demands. DH systems, on the other hand, usually exhibit variations in demand and significant daily peaks. To avoid having to dump excess steam during off-peak periods, the W to E plant could cogenereate electricity and sell it during such periods. Another possibility is for the plant to produce a constant baseload; the DH system could buy the baseload amount and satisfy its peak demands from an outside source. A decision on these alternatives depends on economics and waste supply.

W to E system design must take into account daily and seasonal demands, climate considerations, operational constraints, and state and local regulations. When developing W to E systems, participants must consider waste sizing problems, current tipping fees, and landfill availability, and other steam (or electricity) markets.

Michael Gagliardo

Mr. Gagliardo, Project Manager for the Northeast Maryland Waste

Disposal Authority, spoke about a project in Baltimore, MD. The Northeast Authority was founded in 1980 to manage solid waste in the Baltimore Region. Studies in the late 1970's showed that none of the eleven landfill sites in the region would be full by 1985. The Authority was directed by the jurisdictions in the region to develop a solid waste management system based on the recovery of energy and materials from solid waste. The Authority had most of the requirements for their plant, a market for the energy, and two new landfills underdevelopment for residue.

Project development started two years ago. The Authority is ready to finance the construction. Several consultants and advisors have assisted the Authority in project development, including: a technical advisor. a resource recovery management advisor, a financial advisor, bond council, and a team of underwriters. The W to E plant will process 2000 tons of waster per day and produce 50 MW of electricity. The plant will be owned and operated by the Baltimore refuse Energy Systems Company, an affiliate of Wheelabrator-Frye, Inc.

As a HUD Phase I Grant recipient, Baltimore identified two "Early Start" district heating systems which would profit from refuse derived thermal energy. The Authority now plans to establish and finance a thermal market concurrently with the construction of the plant.

The Authority has incurred project development expenses on the order of $1.9 million. The cost was minimized due to the lack of public opposition, and because no site problems or permit problems arose. No feasibility study was conducted due to the serious waste disposal problems. The total cost of the project in Baltimore is currently estimated at $240 million including financing costs.

Baltimore is satisfied with the W to E project because it will not only solve waste problems but it will also provide competitively priced energy.

WRAP-UP ASSESSMENT OF 28 CITY DISTRICT HEATING PROGRAM

Argonne National Laboratory

This conclusion summarizes the principal findings of the HUD/DOE 28 City DH & C Assessment Program. Argonne National Laboratory was designed by HUD to collect and analyze information about the assessment process and its results. Oak Ridge National Laboratory provided the technical support to the 28 cities and aided HUD in gathering this preliminary information. The findings are subject to further verification. A complete sumary, including technical analysis of DH system characteristics can be obtained from HUD. Overall, the assessment looks favorable.

Characteristics of the 28 Cities

The 28 participating cities are dispersed throughout the country and virtually all are located in areas where the principal project focus on heating rather than cooling. There is a particular concentration in the northeast. The cities represent a good national cross section with respect to both population size and type. They range from New York City at 7 million to Santa Ana Pueblo with about 400 people. Twelve are classified as central cities, twelve are outside of metropolitan areas, and four can be classified as suburbs.

The dominant heating fuels are natural gas and oil for residential and commercial buildings in all but six cities. Sixteen of the cities have no operating DH or C systems. Of the eleven that do six, are private sytems serving mostly central business districts. Four are university systems, and several communities have more than one system (but this does not include private systems serving a single industry.)

Also, the 28 cities represent the full range of utility types. Most cities, according to available data, are served by investor-owned utilities for both gas and electric service. Two cities, Norwalk and Columbus, are served by both investor-owned and municipal electric systems. The three cities served by combined electric, gas, and heat utilites (all investor owned) are Cambridge, Dayton, and Baltimore.

Prospects

The 28 City demonstration showed that the potential for DH is substantial with important benefits to the cities. Twenty-six "probable Early Start" projects were indentified. These are

cities where the projects are considered likely to be built in the near term, and four of these cities are ready for (or into) construction. Three have been elected for HUD support, six to nine more are committed to moving ahead even without federal support, and several others are likely to proceed.

Another benefit from DH in assessment cities is the prospect for thousands of jobs and tens of millions of dollars to be invested into local economies. DH will also be important to cities' revitalization. The overall summary expands on these conclusions.

Examining the 26 probable early start projects reveals that 22 will save money by making use of existing infrastructure investments, such as an existing boiler, all or part of a distribution system, a power plant available for retrofit, or an incinerator from which heat can be extracted. Major obstacles still remain: one project is contingent on new construction over a period of several years and another is having difficulty competing with less expensive fossil fuel.

Utility Involvement in Possible Projects

Utilities can have several roles in a DH project including owning or operating a system, selling steam or hot water, and purchasing electricity. Projects can enhance their economic viability by selling cogenerated electricity, and utilities operating near capacity may find DH systems a desirable way to increase the supply of electricity without having to build new power plants.

Ownership

Great diversity exists concerning ownership of DH systems. Few cities have made final decisions and several have not yet dealt with the ownership question. Although the municipalities expect to remain involved in most projects they anticipate substantial private involvement. This points to the growing interest in joint private/public ventures. There is evidence that some of these joint arrangements may have emerged from the diverse participation in the assessment work groups.

Assessment Work Groups

Assessment Work Groups(AWG's), which were established in all 28 cities under terms of the cooperative agreement, were the entities principally responsible for developing project recommendations. Certain key groups tended to remain active

participants in the assessment project including: local governments, municipal and investor owned utilites and local business or industries. Local governements were the recipients of the funds and held direct work responsibility. Utility, industry, and business were interested in project configurations. In some cities, members of the general public were important AWG participants, as were banks, community groups, environmentalists, and developers.

AWG's Multiple Roles

The specific role of the AWG varied widely among the communities. At this early assessment stage, the principal question was whether conditions existed that could lead to one or more potentialy viable DH project. The AWG acted as supervisor in most cities, which empoyed consultants to help answer questions. Other AWG's were more active by supplying data and technical support, or by actually conducting the special studies needed.

A special role of the AWG was to inject a community perspective into discussions. They kept the technical team from looking at projects that would be locally unacceptable, or helped build community support within their own constituencies or the community at large. Clearly, the role of the AWG's was significant in developing fianl recommendations and most cities indicated that AGW's would be of growing significance as projects developed.

District Heating at Work

Although the 28 City Program demonstrated the widesprad appeal and economic viability of DH, many obstacles stand in the way of undertaking these very complex enterprises. Some of the problems faced were:

1. Present fuel prices are lower than those that could be charged by a DH system.

2. A heat source is uncertain or unavailable (i.e., geothermal sources should be explored).

3. There is insufficient demand for heat (i.e., area too small, no customers, or too widely spread).

4. Environmental problems mitigate against DH.

5. Public/political opposition (i.e., refuse burning or need to

dig up streets) arises to DH.

6. Management concerns are unresolved.

7. Limited bonding authority (i.e. in view of powerful competing demand) makes financing a problem.

Finally, looking at the average costs of projects, it appears that the smaller the projects, the greater the chances of early success. The investments in the local infrastructure would replace money otherwise spent on fuel usually outside the community. DH becomes an important part of the cities' revitalization efforts by providing lower cost, and more reliable energy to areas of the cities most in need. The private economy is strengthened by supplying cheaper energy and by enabling the cities to compete for new industry. Other benefits include the creation of 1,6000 direct construction jobs and an estimated $380 million benefits nationwide.

Overall, the findings show that the cities and nation as a whole will accrue substantial employment and economic benefits from building these systems, as well as providing low cost, reliable heat and cooling.

LUNCHEON SPEAKER

Mike Murphy, Introduction
Albert Quie, Governor of Minnesota, speaker

Mike Murphy

Mike Murphy, Director of the State Energy Office, outlined three roles government can play in district heating (DH). It can act as an informational/educational source, give financial and technical assistance to projects, and provide leadership. He then introduced the Governor of Minnesota, Albert Quie.

Albert Quie

Governor Quie spoke of government and citizen participation in DH. He stated that forces are pushing the country forward in the development of DH systems. The costs of fossil fuels and bad economic situations are forcing people to find efficient methods of heating. The excitement of DH is evident in places like Iceland, where DH has provided warmth on glacial lands.

Governor Quie realizes the fact that people have become more politically active since the Vietnam War. Active demonstrations such as anti-nuclear rallies show the current activism. Governor Quie sees DH as another sign of this grassroots participation. DH offers a practical solution to heating problems in a troubled economic system. Federal and state government cooperation, however, could be improved. The federal government can not provide complete funding for DH. Governor Quie said that bipartisanship should be set aside to look at this single issue.

Leadership in DH, according to Quie, will be provided by people with creative and ingenious ideas. Consultants play an inportant role in DH, especially in its financial aspects. Proposed tax increases will increase participation by the populace and make more people receptive to education and information concerning DH.

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